Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2) Serology in the Vaccination Era and Post Booster Vaccination

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Design and Methods

Utilizing assays for serum SARS-CoV-2 spike (S) protein antibody (Roche) and neutralizing antibody (Diazyme), both >90% IgG, we measured antibodies in 13,189 subjects in the post-vaccination era, as well as to study the increase in these antibodies about two months after a booster injection of a SARS-CoV-2 vaccine.

Background

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic has caused over 6 million deaths world-wide. In the pre-vaccination era, we noted a 5-3% SARS-CoV-2 IgG antibody positivity rate in 81,624 subjects.

Specific Aims

The purpose of the present study was to ascertain the prevalence of positive SARS-CoV-2 spike protein antibodies and neutralizing antibodies in the general population in the post-vaccination era, as well as to study the increase in these antibodies about two months after a booster injection of a SARS-CoV-2 vaccine.

Results

In 2021, in 10,267 subjects, 25-0% had negative S protein levels (<0.80 U/L), 24-4% had low positive levels (0.80-250 U/L), and 50-7% had high positive levels (>250 U/L). Median neutralizing antibody levels were 1·16 and 2·06 AU/mL in the low and high positive groups, respectively. In 2022, we evaluated 2,016 subjects where samples were diluted 1:100 if S protein antibody levels were >250 U/L. Median S protein and neutralizing antibody levels were 2,065 U/L (86.3% positivity) and 2·68 AU/mL (68.0% positivity), respectively. Antibody levels were also measured in 69 subjects before and 60 days after receiving SARS-CoV-2 booster vaccinations. Treatment resulted in a 15-fold increase in S protein antibody levels from 1,010 to 17,236 U/L, and a 6-fold increase in neutralizing antibody from 1·51 to 12·51 AU/mL in neutralizing antibody levels, respectively (both \(P<0.00001\)), with a wide variability in response.

Discussion

Nine months after receiving one of the three vaccine types, all subjects still had some sustained immune response to both S protein antibodies and neutralizing antibodies with the highest levels being observed for the Moderna vaccine and the lowest levels for the Johnson & Johnson vaccine. Approximately 8 weeks post booster vaccination for S protein antibody the median increase was 15·4-fold while neutralizing antibody the median increase was 6·5-fold, indicating a marked variability in response. Our data aligns with prior studies documenting the efficacy of mRNA booster vaccines to stimulate an excellent immune response. Given the sustained immune response, but the lack of clarity about the duration, postvaccination testing of antibody responses can be a vital and practical approach for following vaccinated people and for selecting individuals who need additional boosting because of low responsiveness. A limitation of our post-vaccination study is the small sample size and the fact that we did not assess cellular immunity.

Conclusion

Our data indicate that by early 2022 86% of subjects had positive SARS-CoV-2 S protein antibody levels, and that these levels and neutralizing antibody levels were increased 15-fold and 6-fold, respectively, 60 days after SARS-CoV-2 booster vaccination.

References
